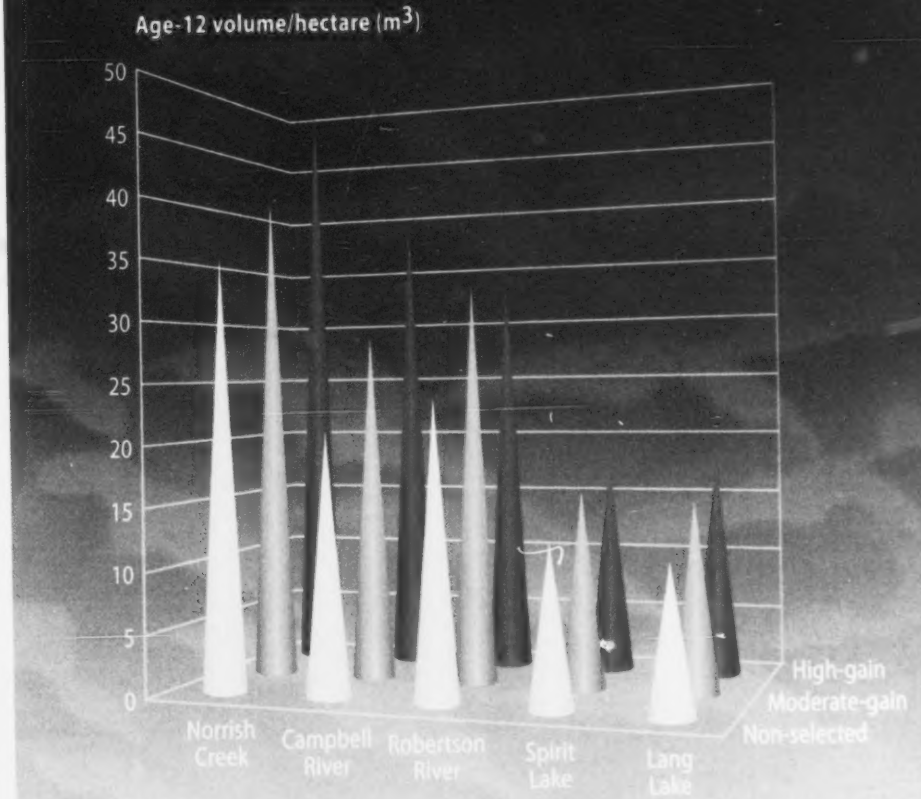
LEGISLATIVE LIBRARY OF BRITISH COLUMBIA
3 3298 00387 2877

FGC Forest Genetics Council of British Columbia

ANNUAL REPORT 2009/2010



DOC
BC
F67
B
2009/10
c.3

LEGISLATIVE LIBRARY
VICTORIA, B.C. V8V 1X4
JAN 12 2011

Table of Contents

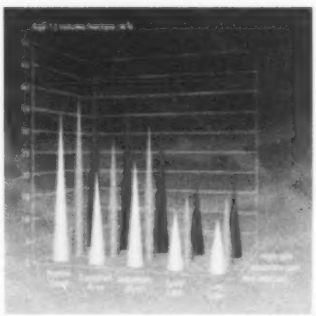
Canadian Cataloguing in Publication Data
Forest Genetics Council of British Columbia
Annual report. -- 2000/2001

Annual.
Title from cover
Issuing body varies.
ISSN 1499-125X = Annual report – Forest Genetics Council of British Columbia

1. Forest Genetics Council of British Columbia – Periodicals.
2. Trees –
SD399.5.B74 634.9'8'09711'05 C2001-960195-6

Cover graphic – Coastal Douglas-fir genetic gains in volume

Results from a study designed to estimate: a. area-based yield gains in stem volume at a range of genetic worth (GWg) levels; b. interactions between genetic gain and site index; and c. interactions between genetic gain and tree spacing. Five field sites were planted with four spacing levels and three levels of seedlot GWg (0, 10, and 18). Trees are planted in a replicated experimental design with 144-tree block plots at each level of GWg and spacing. Stem-volume gains at age 12, averaged across all spacings, exceed expectations (about 50% vs. 36%) for the GWg 18 seedlot. Gains are expected to diminish to expected levels by rotation due to normal stand development and competition. No interactions are observed between genetic gain and site index or plantation spacing, indicating stable growth performance across a range of sites and stand densities for this age.



Acknowledgements

This Annual Report presents 2009/10 performance towards provincial-level objectives set out in the Forest Genetics Council Strategic Plan for 2009 to 2014. Financial summaries are presented for spending under the Forest Investment Account Forest Genetics Conservation and Management Program (FGCM). Further details are available in the FGC Business Plan for 2009/10, and the Tree Improvement Program Projects Report for 2009/10. This Annual Report, the 9th in a series beginning in 2001, is shorter than past reports due to increased focus on provincial-level performance indicators and the removal of subprogram indicators.

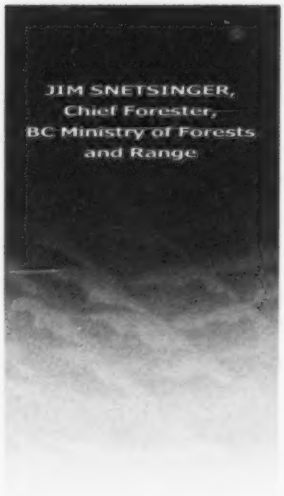
The period covered by this report was a difficult one for all involved in forestry in BC. Broad economic deterioration, substantial loss of wood-product markets, and reductions in revenues to the Crown resulted in high-level management responses that placed considerable pressure on the activities organized through the FGC. Significant budget reductions, delays in budget and contract approvals, and staff layoffs resulted in a great deal of stress for many of the people involved and in projects being postponed or cancelled. Despite these setbacks, seed orchard production was generally high and the overall progress towards FGC objectives continued.

The cooperative approach led by the FGC, combined with strong leadership by co-chairs Brian Barber (MFR) and Kerry McGourlick (Western Forest Products Inc.), continues to support the advancement of tree improvement efforts in BC. All involved are thanked for their support and work during the year, in particular Coast and Interior TAC chairs Annette Van Niejenhuis and Tim Lee, Genetic Conservation TAC chair Dave Kolotelo, Pest Management TAC chair Robb Bennett, Extension TAC chair Diane Douglas, and Lee Charleson, chair of the Seed Transfer TAC and the Genetic Resource Decision Support Steering Committee.

Provincial Chief Forester Jim Snetsinger is also thanked for his ongoing support and guidance.

JACK WOODS,
Program Manager,
Forest Genetics
Council of BC

Photo credits: V. Berger, T. Funda, R. Hansinger, G. Pieper, D. Reid, J. Woods



JIM SNETSINGER,
Chief Forester,
BC Ministry of Forests
and Range

Message from the Chief Forester

I'm pleased to participate in the ninth consecutive annual report of the Forest Genetics Council of BC. Although the period of this report was particularly difficult for many sectors of the economy in BC and throughout the world, the FGC advanced its objectives through strong leadership, collaboration, and perseverance. In particular, I note the substantially increased average genetic worth of seedlots sown for Crown land - from 14 to 16 percent – and use of select seed - from 53 to 60 percent. Also of note are the bumper crops from Ministry and private seed orchards, which combined to produce enough seed to grow about 147 million seedlings. This seed will improve provincial timber supply, increase future harvest options, and provide socio-economic benefits for many areas of BC.

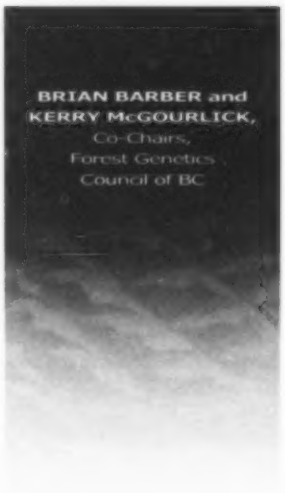
The economy and government restructuring dominated the period covered by this report. The economic downturn shifted the Ministry's business to improving the competitiveness and innovation of the forest sector. The Tree Improvement Program is part of this, and a significant contributor to enhancing provincial timber supply. Over the ensuing year, many provincial forestry investments will be examined and adjusted to ensure that the priorities of the provincial government are being met. In addition, efficiencies such as increased professional reliance will be reviewed as means of reducing costs for both the private and public sector.

Climate-change response also continues to be a priority of the MFR. The overall tree improvement and genetic resource management program (GRM) is a significant component of the programs being developed. I'm confident that research on the adaptation of indigenous commercial species to present and future climates will lead to a pragmatic and operationally-efficient system of seed zones and seed transfer standards that will help maintain the resilience of planted forests and the long-term competitiveness of the forest industry. A part of this overall response is an effort to realize additional value from tree improvement efforts through the sale of carbon credits. This effort is being led through Pacific Carbon Trust, with input on protocols from the MFR, and may contribute additional resources to the GRM effort in future years.

I would like to acknowledge the efforts of Council for their collaborative work in drafting the "Chief Forester Principles for Private and Public Sector Participation in Seed Orchards". This collaborative agreement will allow all parties to move forward with a clear understanding of their respective roles and decision-making expectations. A strong partnership between the Ministry and the private sector will also ensure we can meet the objectives of Council.

While many difficulties were encountered with staffing and budgets during the period of this report, I'm pleased to see that the people involved continued to focus on and support the key components of the provincial program. I would like to thank Council members and the members of all FCG technical committees for their efforts and cooperation during the past year. Melanie Boyce, Deputy Chief Forester, and I look forward to working with Council again in 2010/11.

Message from Forest Genetics Council Co-Chairs



BRIAN BARBER and KERRY McGOURLICK, Co-Chairs, Forest Genetics Council of BC

During the period of this report, both private companies and public agencies involved in forestry went through restructuring, downsizing and financial constraint. These resourcing constraints caused delays and cancellations of a number of projects. While stressful and difficult for all involved, we are pleased to note that people working at all levels in this program responded positively and professionally, and worked hard to ensure that key projects were completed.

There were some notable bright spots in the year, such as the large increase in the percentage of select seed used provincially (53 to 60 percent - see page 7) and the excellent seed production in many orchards; particularly Douglas-fir and lodgepole pine. Overall orchard production was close to two metric tonnes of seed across eight species and many seed zones. These successes are the result of many years of good management. The legacy of the 2009 crop will be realized with increased timber supply and carbon sequestration in provincial forests for many years.

The Provincial Chief Forster, Jim Snetsinger, also endorsed a set of principles outlining the roles of the public and private sectors involved in seed production for Crown lands. These principles will guide cooperative decision-making regarding management and changes to orchards. Council also completed another priority ranking of seed planning units to guide tree improvement investments. These rankings will ensure that funds are directed to species and seed zones with the highest potential for adding value. Also completed was a thorough analysis of western larch climate-based seed transfer opportunities. This analysis combined genecology data, climate modeling, and operational considerations. The results were used to (conservatively) expand the suitable area of use of larch seed under the Chief Forester's Standards for Seed Use (see page 14).

With increasing attention on climate change and global carbon budgets, new opportunities are emerging for tree improvement to add to the carbon sequestration rate of planted forests. Forest carbon offsets are being considered by the Pacific Carbon Trust, and within the Western Climate Initiative. As their policies and protocols evolve, opportunities to contribute to the removal of atmospheric carbon and add value to select seed use may emerge through the sale of carbon offsets. Council will continue to participate in these discussions and explore practical means of quantifying and selling carbon offsets associated with use of select seed.

We would like to recognize the support of the Forest Investment Council and the funding they provided through the Forest Investment Account (now the Land Base Investment Strategy). Also thanks to Jim Snetsinger, Chief Forester, and Melanie Boyce, Deputy Chief Forester, for their continued support. Finally, we would like to thank all members of Council and its' technical committees for their contributions during the year. Without the dedication and innovation demonstrated by these people, this program would not be successful.

Forest genetic resource management includes conservation, value gain, and forest resilience.

1.0 Introduction

This Annual Report describes progress on work outlined in the Forest Genetics Council of BC (FGC) Business Plan for 2009/10. The Business Plan and this Annual Report focus on Forest Investment Account (FIA) funding, although performance indicators used at the provincial levels represent the combined effort and investment of all cooperators. This Annual Report includes only provincial-level performance indicators outlined in the FGC Strategic Plan for 2009 to 2014. The FGC Projects Report presents more detailed reports on individual projects.

1.1 Tree improvement and forest genetic resource management in British Columbia

Tree improvement and forest genetic resource management (GRM) include conservation of the genetic resource of indigenous forest tree species, increasing value through tree breeding and seed production, and enhancing forest resilience through scientifically-based seed transfer standards and the maintenance of genetic diversity.

The Forest Genetics Council leads business planning for the provincial tree improvement and genetic resource management program.

1.2 About the Forest Genetics Council of British Columbia

The FGC is a multi-stakeholder group representing government agencies (Ministry of Forests and Range, Canadian Forest Service), the forest industry, universities, and non-industrial private companies. The mandate of the FGC is to champion forest GRM, to oversee strategic and business planning for a cooperative provincial GRM program, and to advise the provincial Chief Forester on GRM policies.

The FGC acts as a forum through which stakeholders can cooperate in program development, seek efficiencies in implementation, and lead business planning for provincial investments through the FIA Forest Genetics Conservation and Management Program (FGCM). During the term of this report, the provincial FIA-FGCM was a major funding source for GRM in British Columbia. Industry, MFR, and university cooperators also contributed substantial resources.

Council set the following vision statement and objectives in its five-year Strategic Plan (2009-2014), and annually develops a Business Plan outlining activities to meet the objectives.[1]

Vision

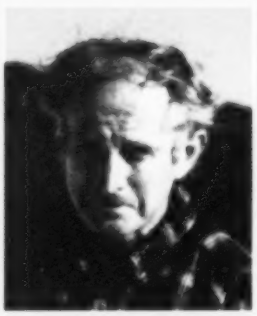
BC's forest genetic resources are diverse, resilient, and managed to provide multiple values for the benefit of present and future generations.

Objectives

- *Increase the average volume gain of select seed used for Crown land reforestation to 20% by the year 2020*
- *Increase select seed use to 75% of the provincial total sown by 2014*
- *Adequately conserve the genetic diversity of key populations of all forest tree species native to BC by 2015, through a combination of in situ, ex situ, and inter situ conservation*
- *By 2020, high-quality genecology research information will guide operationally efficient climate-based seed transfer policy and practice for all trees planted in BC*
- *Coordinate stakeholder activities and secure the resources needed to meet Business Plan priorities*
- *Monitor and report progress in genetic resource management activities*

Dr. Michael Carlson

Mike began his career with the BC Ministry of Forests and Range Research Branch in 1983 as the geneticist for lodgepole pine. Bringing ideas, energy, and enthusiasm, Mike quickly advanced the lodgepole pine breeding program with his pragmatic and field-oriented approach. Mike's energy carried him into leadership roles with western white pine, poplar, and birch programs, plus a wide variety of other projects. Mike's ability to generate enthusiasm and cooperation in others has led to him making major contributions to forest genetics and forestry in British Columbia. Mike also served as chair of the Interior Technical Advisory Committee and as a member of the Forest Genetics Council from 1998 to 2008. Never to be held down, Mike has continued to work as hard as ever in a scientist emeritus position since his retirement in March, 2010.



[1] For more information on the Forest Genetics Council, see *http://www.fgcouncil.ca.*

2.0 Budget and Expenditures

Forest Investment Account Forest Genetics Conservation and Management program allocations and expenditures for the 2009/10 fiscal year are shown in Table 1. The table does not include in-kind, staff salaries, and other substantial inputs by industry, MFR, and university cooperators who contribute to the success of GRM activities in B.C.

Table 1
Summary of Forest Investment Account Forest Genetic Conservation and Management program budgets and expenditures for the period April 1, 2009 through March 31, 2010 ($ x 1000).

Subprogram	Budget ($)	Expenditures ($)
Genetic Conservation	396	279
Tree Breeding	2,032	1,870
Operational Tree Improvement Program (OTIP)	747	710
Extension and Communication	101	101
Genetic Resource Decision Support	40	40
Cone and Seed Pest Management	360	349
Genecology and Seed Transfer	300	185
Administration	15	15
Incremental projects	299	204
SelectSeed Ltd. orchards and FGC program management	710	710*
Forest Investment Account Tree Improvement Program Contribution	**5,000**	**4,403**

* SelectSeed FIA allocation shown. Total SelectSeed expenditure $958,084; difference supported through seed sale revenue and investment income.

Expenditures fell short of budgets primarily due to a broad provincial government response to significant shortfalls in revenue expectations. Although business planning and recommendations on project expenditures were completed prior to the start of the fiscal year, the release of FIA funds for projects and contracts was significantly delayed. In addition, limitations placed on contract types and on travel resulted in some projects not proceeding as planned. The biological timelines and limitations of seasonal weather, combined with delays in the release of funds, resulted in projects being cancelled. These issues were particularly difficult for the Tree Breeding and Genetic Conservation subprograms. Despite these unavoidable problems, people leading projects in all subprograms responded quickly to changes to ensure priority work was completed.

3.0 Performance Indicators

Progress towards objectives set out in the FGC Strategic Plan for the period 2009-2014 (summarized above) are measured and reported annually. Two of these objectives (increase select seed use to 75% and increase the average genetic worth (GWg) of select seed to 20%) have been measured and reported since 2000. Performance on all Strategic Plan objectives is reported below.

3.1 Increase seedlot genetic worth[2]

Objective

Increase the average volume gain of select seed used for Crown land reforestation to 20% by the year 2020

Performance

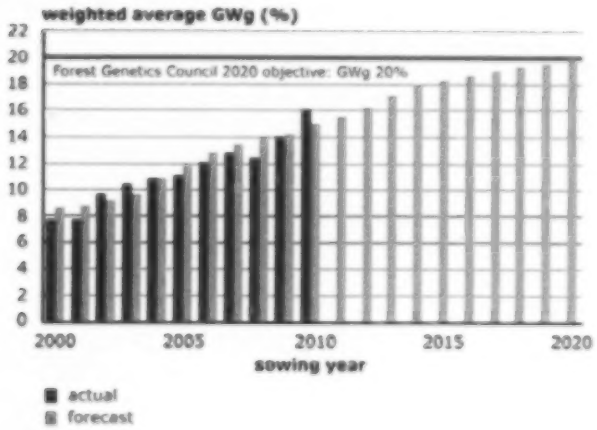


Figure 1
Annual actual and forecast average genetic worth for stem-volume growth (GWg) of select seed sown in BC

Genetic worth for growth (GWg) increased substantially during the 2010 sowing year (Figure 1). This increase resulted from an overall trend to higher-gain seed production in provincial orchards. This trend reflects the ongoing selection of higher-gain parent trees in breeding programs and the incorporation of these parent trees in orchards with the support of the Operational Tree Improvement Program (OTIP). A significant part of the large increase from 2009 to 2010 is due to increased use of higher-gain lodgepole pine seed.

[2] Genetic worth is a measure of rotation-age gain in a specific trait, relative to non-selected wild seed. Genetic worth for growth (GWg) is a measure of stand-based gains in wood volume expressed as a percentage.

3.2 Increase select-seed use

Objective

Increase select seed use to 75% of the provincial total sown by 2014

Performance

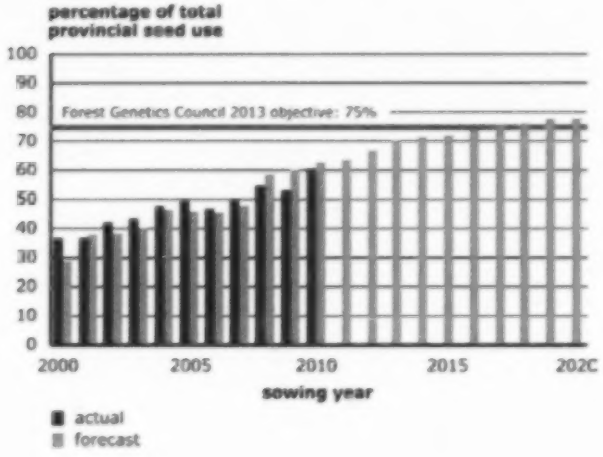


Figure 2
Actual and Species-Plan forecasts of select-seed use as a percentage of total provincial seed use by year.

Select seed use as a percentage of total sowing jumped significantly from 53 percent in the 2009 nursery-sowing year to 60 percent in 2010 (Figure 2). This increase is due primarily to increased supply and use of lodgepole pine and interior Douglas-fir orchard seed, as well as to an overall decrease in provincial sowing that has reduced pressure on the limited supply of orchard seed for some species (Figures 3 and 4).

Provincially, large fluctuations in provincial sowing and planting have occurred since 2005, due to response to the mountain pine beetle epidemic that increased harvest and planting and to the more recent economic slowdown that has reduced harvest and the need for planting (Figure 3). Total sowing in the 2010 sowing year was approximately 180 million, a substantial decline from the high of 280 million in 2006.

As shown in Figure 3, the overall total use of orchard seed has dropped since the large sowing years of 2006 and 2007. This drop is primarily due to reduced sowing of interior spruce[3]. As nearly all interior spruce sowing over the last decade is with orchard seed, and due to the large numbers sown, the reduced sowing has significantly impacted provincial totals despite increases for other species. It is anticipated that, as sowing increases in future years, the total use of orchard seed will increase.

[3] Interior spruce refers to white spruce, Englemann spruce, and the hybrid complex of these species. Interior spruce produces large quantities of seed in orchards, allowing nearly all provincial demand to be met with orchard seed.

The use of orchard seed is limited primarily by its availability. For species such as coastal Douglas-fir, western redcedar, interior spruce, and western larch, seed orchards supply nearly all of the seed sown each year. Meeting the 2014 objective for select-seed use is primarily dependent upon increased production from lodgepole pine and interior Douglas-fir orchards. Production for these species continues to rise, but challenges remain for lodgepole pine. These challenges are being addressed through the FGC-led program.

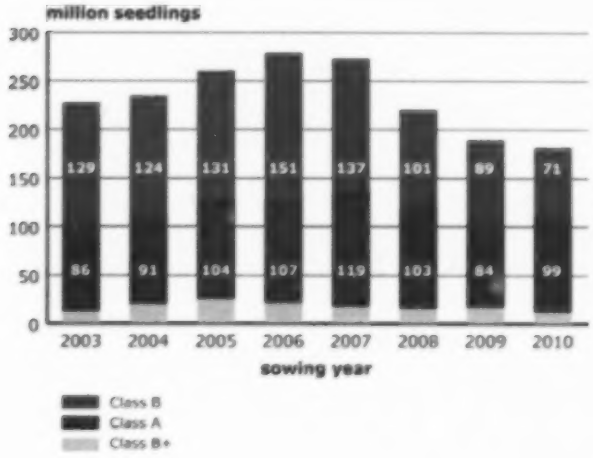


Figure 3
Provincial sowing of orchard (class A), wild-stand (class B), and superior provenance seed (class B+) by year.

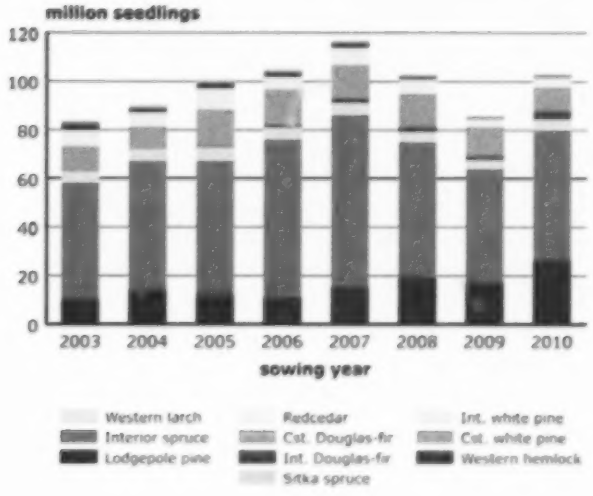


Figure 4
Provincial sowing of orchard seed by species from 2003 to 2010.

Feature

Interior Douglas-fir breeding and seed production

Breeding programs for interior Douglas-fir (Fdi) began in the early '80's under the leadership of Barry Jaquish. His effective strategy of field testing open-pollinated seed from parents selected in wild stands allowed fast progress. By the mid '90's, progeny tests had grown to an age that allowed early selection of the top-performing parent trees for seed orchards. An interesting result of the progeny testing were large differences in observed growth rate among the offspring of various parent trees, relative to that observed with most species in BC. These differences allowed the selection of very high-gain parents for seed orchards and the subsequent production of high genetic worth seedlots. This was particularly true for the "interior wet belt" parents, across all elevations in the Nelson seed zone.

Approximately 10 years ago, the top 60 or so high- and low-elevation parents from the Nelson zone Fdi breeding program were selected for each of a low- and high-elevation orchard. The low elevation orchard was established at the Armstrong site of Pacific Regeneration Technologies Ltd. in partnership with FGC-owned SelectSeed Ltd, and the high-elevation orchard was established by the MFR at the Bailey site near Vernon. In 2009, a combination of good management and good weather conditions at both sites resulted in large cone crops on what are still relatively young orchards. A total of 141 hectolitres of cones, yielding a total seed crop of 115 kg (84 for low and 31 for high elevation) capable of growing about 5.3 million seedlings was produced. Genetic worth (GWg) values on these low and high-elevation seedlots are, respectively, 27 and 33, making them among the highest-gain seed produced in BC to date.

Douglas-fir seed orchard at the MFR's Bailey site near Vernon; producing seed for higher elevation areas in the Nelson seed zone *(C Walsh photo)*

Developing Douglas-fir cones *(J. Woods photo)*

3.3 Adequately conserve genetic diversity

Objective

Adequately conserve the genetic diversity of key populations of all forest tree species native to BC by 2015, through a combination of *in situ*, *ex situ*, and *inter situ* conservation

Performance

All 50 tree species indigenous to BC are included in genetic conservation monitoring. Predictive models based on inventory data have estimated *in situ* conservation status for each species within each biogeoclimatic (BEC) zone[4]. For commercial species, reporting includes conservation status of *in situ*, *inter situ*, and *ex situ*[5] populations. Results to date show that of 232 combinations of species and zones, 30 are identified as requiring verification, and three are identified as requiring protection.

Verification work testing the model predictions and methods with on-site surveys will be complete by the end of 2010. These ground-truthing results may lead to revisions of the methodology used for development of the genetic conservation catalogue. It is anticipated that the coarse-filter BEC-zone matrix may be replaced over time by other subdivisions that more accurately reflect genetic population distributions for individual species. Reporting will include protection status for each species, and indicate which require additional protection through *in situ* and/or *ex situ* conservation.

Fundamental to assessing the conservation status of BC's indigenous tree species is knowledge of each species' natural pattern of genetic diversity and of the geographic subdivisions of a species range that contain genetic populations that are sufficiently different to warrant attention for conservation. For commercial species, substantial information on genetic diversity exists. For non-commercial species, less is known. Under the Genetic Conservation Subprogram, research is underway for a number of non-commercial species, including Garry oak, whitebark pine, and Pacific dogwood, to provide information to guide genetic conservation activities.

It is also a goal under this objective to securely store representative samples of seed from as many species/zone combinations as possible. A total of 8,000 samples are currently in storage at the MFR Provincial Tree Seed Centre.

---

[4] Chourmouzis, C., A. D. Yanchuk, A. Hamann, P. Smets, and S. N. Aitken. 2009. Forest tree genetic conservation status report 1: *In situ* conservation status of all indigenous British Columbia species. Centre for Forest Conservation Genetics, Forest Genetics Council of B.C., and B.C. Min. For. Range, For. Sci. Prog. Victoria, B.C. Tech. Rep. 053. www.for.gov.bc.ca/hfd/ pubs/Docs/Tr/Tr053.htm

[5] Krakowski, J., C. Chourmouzis, A.D. Yanchuk, D. Kolotelo, A. Hamann, and S.N. Aitken. 2009. Forest tree genetic conservation status report 2: genetic conservation status of operational tree species. Centre for Forest Conservation Genetics, Forest Genetics Council of British Columbia, and B.C. Min. For. Range, For. Sci. Prog. Victoria, B.C. Tech. Rep. 054. www.for.gov.bc.ca/hfd/ pubs/Docs/Tr/Tr053.htm

Current priorities are whitebark pine (a provincially blue-listed species), limber pine, and sub-alpine larch. Other non-commercial species are also receiving priority within the limits of budgets and staff time. It is anticipated that this *ex situ* genetic archive will continue to expand in future years.

Feature

Seed collections for the genetic conservation of threatened whitebark pine

Whitebark pine (*Pinus albicaulis*) is the top priority for forest tree genetic conservation in BC and Alberta, as well as in many U.S. states. Over the past few decades, stands have suffered unprecedented mortality from an introduced fungal pathogen and from the recent mountain pine beetle epidemic. This mortality is exacerbated by fire suppression that is changing the species habitat and reducing its ability to naturally regenerate. Future ecosystem shifts due to climate change are also a cause for concern, as whitebark pine grows near the timberline in areas strongly impacted by climate change.

Whitebark pine seeds are one of the largest among North American pine species, and are an important food source for many animals, including the Clark's nutcracker and grizzly bears. Because of this, obtaining seed for conservation collections requires caging cones in the early summer to prevent busy foragers from getting them. From 2007 to 2010, funds directed by the FGC have supported cone collections from natural stands throughout BC. The objective of these collections is to capture a broad spectrum of the species genetic diversity. Seeds are archived at the MFR Provincial Tree Seed Centre as a long-term *ex-situ* germplasm reserve. These efforts have also been supported by work from volunteers from conservation groups who have helped with cone caging, cone collection, and planting research trials. The Provincial Tree Seed Centre now safely stores collections of whitebark pine from 24 locations and over 300 individual trees, with more seed to be added in coming years.

In addition to *ex situ* conservation measures, projects have been undertaken at the UBC Centre for Forest Conservation Genetics to better understand the genetic differences among populations.* Other studies are investigating opportunities for assisting whitebark pine migration to areas north of its current range that are expected to become suitable habitat as climates change (S. McLane, PhD dissertation in progress).

*Bower, A. B, and S. N Aitken. Ecological genetics and seed transfer guidelines for *Pinus albicalus* (Pinaceae). Am. J. of Botany 95(1):66-76.

Whitebark pine killed by white pine blister rust
(J. Krakowski photo)

Whitebark pine seeds (actual size) are an important food source for many animal species
(J. Woods photo)

Whitebark pine cone
(J. Woods photo)

Clarks's nutcracker foraging for whitebark pine seeds
(J. Woods photo)

3.4 Climate-based seed transfer

Objective

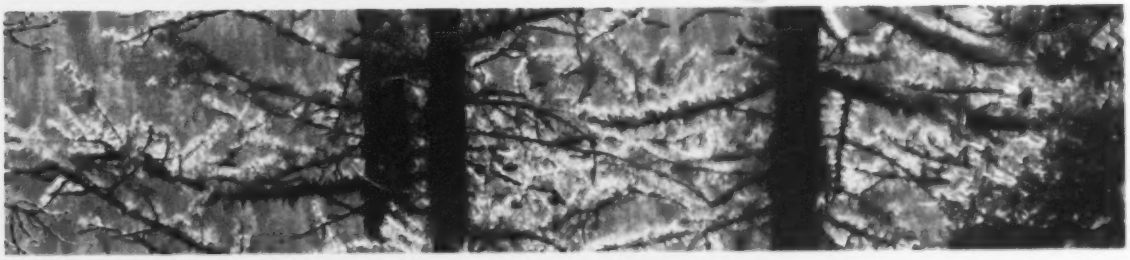
By 2020, high-quality genecology[6] research information will guide operationally efficient climate-based seed transfer policy and practice for all trees planted in BC.

Performance

Climate-based seed transfer systems for operational planting are informed by genecology research. Development of a comprehensive climate-based seed transfer standard that will apply to all seed zones in BC is underway. During the period of this report, seed zones and seed transfer standards for western larch were modified by the MFR in response to climate-based analyses of seed zone boundaries and suitable climatic envelopes for this species. This analysis was possible due to significant field-based western larch genecology data and the use of climate modeling; both of which are supported through this funding program.

Adaptation of forest trees is driven primarily by climate. As most species are closely adapted to their local climate, limits on seed transfer are required to ensure plantations are healthy and productive. As climates change, however, the areas to which tree populations are optimally adapted will shift. Climate-based seed transfer will use information generated through long and short-term genecology research and climate modeling to match tree populations with appropriate climate envelopes in a way that will maintain productivity and resilience. This complex task is currently under development and is expected to be a long-term endeavour that will require periodic revision to include new information and methodology.

As a comprehensive climate-based seed transfer system is introduced in BC, future FGC Annual Reports will provide metrics describing the percentage of provincial planting completed under these new standards. It is anticipated that such standards will be implemented before 2014, and will apply to most species and zones found in BC.



Subalpine larch *(J. Woods photo)*

[6] Genecology is the study of the geographic distribution of genetic differences among populations of trees.

Feature

Western larch climate-based seed zones

The natural range of western larch (*Larix occidentalis*) in BC is limited to the south-eastern corner of the province. This valuable and fast-growing species has long been of interest to foresters, leading to the establishment of many small test plantings outside its natural range, including the ICH zone northwest of Smithers. The fast growth of many of these test plantations, combined with expectations that species will migrate north in response to climate change, encouraged Barry Jaquish (MFR, Research Branch) to investigate opportunities for commercial planting of western larch outside its current distribution.

Sophisticated new methods for climate modeling and spatial analysis, combined with information on the geographic patterns of genetic diversity, allowed a comprehensive analysis to better understand which seed sources of western larch might be suited to climatically similar areas outside the species' natural range. Projections of climate change provided additional information on the suitability of specific climatic areas for western larch.

This complex analysis was carried for the full species range, plus other potentially suitable areas, by Barry Jaquish and Dr. Gerald Rehfeldt (retired, USDA, Forest Service). Results were transferred to the MFR Tree Improvement Branch for an operational review and the development of seed transfer policy. Revisions to the *Chief Forester's Standards for Seed Use* were implemented early in 2010 and allow limited use of specific western larch seed sources in climatically-similar areas north of its natural range. It is anticipated that these changes will increase timber productivity and landscape diversity in specific areas of BC. It also represents a proactive approach to mitigate the effects of climate change on BC's forests.

Business planning and funding through the FGC has supported field research, climate modeling, and the analysis that led to modifications of seed transfer policy. This work illustrates how field trials implemented through the provincial tree improvement program, sophisticated climate modeling tools, an effective policy framework, creative ideas, and well-organized collaboration can result in policy changes that are useful and will enhance long-term socio-economic benefits from BC's forests. It also demonstrates FGC and MFR commitment to respond to climate change.

Western larch stand in the Kettle Valley *(J. Woods photo)*

Developing western larch cones at the Kalamalka Seed Orchard *(C. Walsh photo)*

Existing and new western larch seed zones (M. Leroy, MFR TIB)

3.5 Coordinate stakeholder activities

Objective

Coordinate stakeholder activities and secure the resources needed to meet Business Plan priorities

Performance

During the period of this report, the FGC led the completion of the following:

- Activity plan and associated budget recommendations for the Land Base Investment Strategy Tree Improvement Program for 2010/11
- A published Business Plan and full set of species plans for 2009/10
- Published FGC Annual Report and Projects Report for 2008/09
- Recommendations to the Provincial Chief Forester regarding private and public sector participation in seed orchards
- Submissions to the MFR silviculture strategy development process and to Pacific Carbon Trust for their process of developing a call for the purchase of carbon offsets generated from the use of select seed

Council met five times during the fiscal year. These meetings, in combination with subcommittee work done under the overall FGC structure, resulted in the efficient coordination of activities among a broad range of stakeholders from the MFR, major licensees, smaller licensees, universities, the Canadian Forest Service, other provincial ministries, and non-licensee private firms. The full range of activities included policy recommendations, tree breeding programs, genecology research, seed orchard operations, genetic conservation, cone and seed pest management, extension, cone and seed pest management, and systems for coordinating seed use information and seedling orders. In addition, Council elected members to the board of directors of Council-owned SelectSeed Ltd. and oversaw SelectSeed operations and financial reporting.

Lodgepole pine seed orchard producing for the Thompson Okanagan seed zone. Managed by Pacific Regeneration Technologies Ltd. in partnership with SelectSeed Ltd. *(J. Woods photo)*

3.6 Monitor and report progress

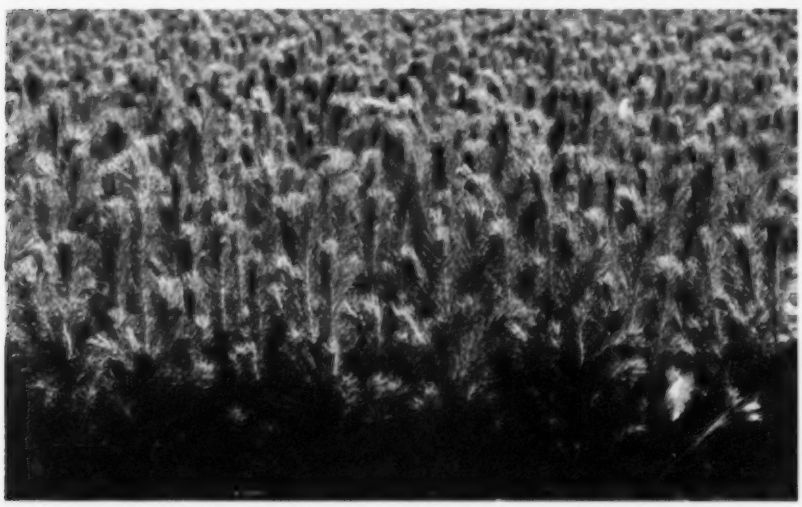
Objective

Monitor and report progress in genetic resource management activities

Performance

This objective was primarily met through the development, approval, and publication of a comprehensive Business Plan for 2009/10 and "species plans" that outline breeding programs, seed orchards, historic seed use and production, and other data relevant to an efficient multi-stakeholder provincial program. Performance indicators are used for major provincial activities. Project level reporting is summarized in the Tree Improvement Project Report.

Reporting is also carried out through verbal presentations to a wide variety of stakeholder groups, conferences, meetings, and to managers with program oversight.



Interior spruce seedlings grow from orchard seed by Sorrento Nurseries Ltd. *(J. Woods photo)*

4.0 2009 Orchard Seed Crops

Cone and seed production in 2009 resulted in large crops from many orchards, including Douglas-fir on the coast and in the interior, and western larch. Lodgepole pine orchards had better-than-normal seed set (filled seeds per cone), resulting in larger crops than previous years.

Overall, the total harvest of 1,981 kilograms of seed is sufficient to grow approximately 147 million seedlings (Table 2). Lodgepole pine orchards also have a good crop of first-year cones for harvest in 2010, although overall orchard production for this species still falls short of seed needs for most seed planning units.

Table 2
Summary of 2009 seed crops from all provincial orchards.

Species	Seed produced (kg)	Seedling equivalents (million)
Interior spruce	253	34.8
Lodgepole pine	212	28.1
Western larch	259	25.9
Interior Douglas-fir	321	14.9
White pine	112	1.4
Western redcedar	27	5.6
Sitka spruce	5.4	0.9
Coastal Douglas-fir	772	32.0
Western hemlock	19.5	3.8
	1,981	147.4

Doug Ashbee

Doug retired from the Research Branch of the Ministry of Forests and Range, in early 2010 after 40 years of dedicated service. Starting with the Protection Branch in 1970, Doug joined the Research Branch in 1978 as the Provenance Technician in the provenance research program. Working province-wide, Doug quickly developed valuable expertise and experience in a broad range of species, ecosystems, and project types. Doug's much appreciated positive attitude, good humour, and attention to the detail required for high-quality research will be greatly missed.